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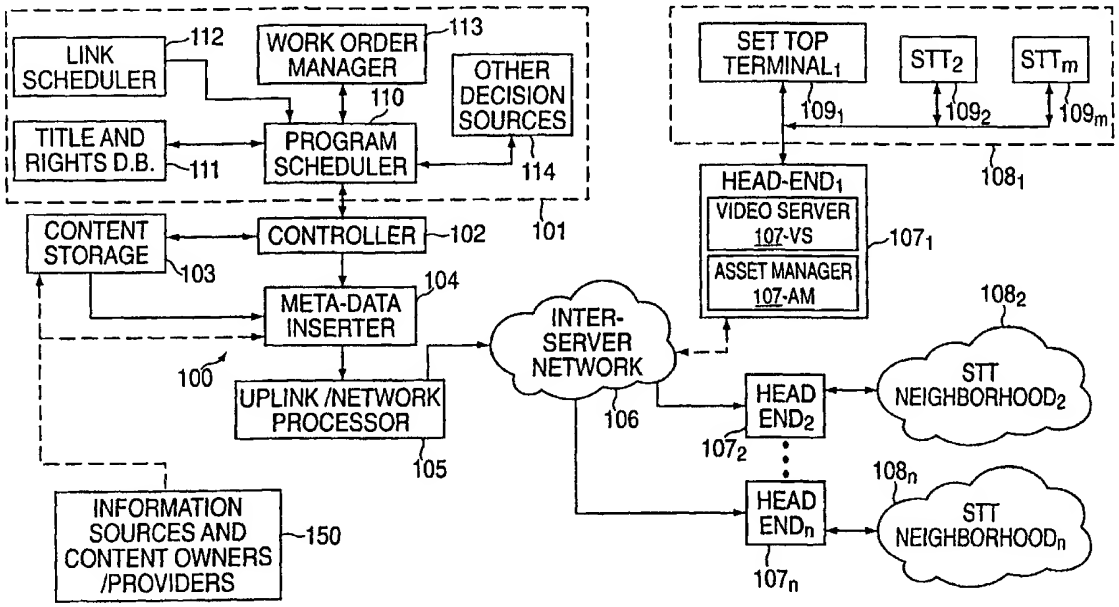

(57) Abstract

A method and apparatus for incorporating server addressing and content–related "meta data" within content streams provided to various servers such that receiving servers may efficiently process the content stream.

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METHOD FOR DISTRIBUTING AND MANAGING CONTENT FOR ON DEMAND APPLICATIONS UTILIZING LOCAL STORAGE

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims benefit of U.S. Provisional Patent Application Serial Number 60/127,123 (attorney docket number 041), which was filed on March 31, 1999 and is incorporated herein by reference in its entirety.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to information distribution systems in general and, more particularly, to an information distribution system in which a centralized source of information efficiently provisions information servers such that subscribers interacting with the information servers may retrieve the provisioned information.

2. Description of the Background Art

In an information distribution system, such as video-on-demand (VOD) system, an information server (e.g., a head-end in a cable television system) must control of the distribution of requested information to ensure that requests for information, such as video, audio and other "content," are satisfied in an orderly manner. To achieve this, the information server typically stores, on a local storage device, at least frequently requested information. The stored information is provided to the server and, possibly, a large number of other servers via a primary or distribution network linking the information servers and a central information source. Primary content distribution networks comprise high bandwidth data links that are typically unidirectional or, at the very least, asymmetrical in terms of bandwidth usage.

Once the content is stored at a local information server, the content must be managed according to key attributes associated with the content. These key attributes may differ on a content by content basis and on a server by server basis. That is, different content may be associated with different presentation attributes, such as a movie viewing window and other attributes associated with a movie which may not be associated with a television show. Similarly, different servers operating in different geographic regions may have different rights to particular content. For example, sporting events may be "blacked out" in certain geographic areas unless conditions such as sold out stadiums or other conditions are met. Thus, a synchronization of the above attribute information and the content must occur. This attribute synchronization is usually handled along with the control processing via secondary or control network.

The above described topology of a secondary network directing content transfer via a primary data transfer network is used due to the mismatch between the primary network characteristics and the content itself. Specifically, information streams or content streams are typically very long, high bandwidth data streams such as movies or television programs. Unlike primary networks, secondary networks or control networks are typically very bursty and most suitable for low bandwidth data. Thus, typical secondary networks or control networks are ill suited to the delivery of such long, high bandwidth data streams.

Unfortunately, the above described topology is relatively complicated and requires a significant processing overhead at each information server to ascertain, for example, whether content being received should be ignored, processed or stored by the server, which attributes should be associated with the content being stored and the like. Thus, the provisioning of more than one information server with content can be quite complex in terms of attribute/content synchronization, server functionality and other parameters.

Therefore, it is seen to be desirable to provide a method and apparatus for streamlining the process of provisioning information servers such that attribute information and control information may be

synchronized and provided in a more efficient manner (i.e., minimizing the use of complex control protocol or methodology).

SUMMARY OF THE INVENTION

A method and apparatus for incorporating server addressing and content-related "meta data" within content streams provided to various servers such that receiving servers may efficiently process the content stream. In this manner, a head end or server being provisioned may process a received content stream in a somewhat autonomous manner such that the head end or server does not need to communicate extensively about content-provisioning issues with the information production or transmission source. Moreover, data defining various technical, legal and business requirements regarding the use of the provisioned content between the initial content sources (e.g., television stations, movie studios, various copyright owners and the like) and the information distribution system owners, subscribers and/or users may be included in the content stream, thereby enhancing compliance with these requirements.

Specifically, in an information distribution system including at least one information server interacting with a respective group of subscribers, apparatus for provisioning an information server according to the invention comprises: a controller, for synchronizing a content stream and attribute data associated with the content stream, the attribute data indicative of at least a server utilizing the content stream; a data inserter, for inserting the respective attribute data into the content stream; and means for providing the content stream including the attribute data to the server utilizing the content stream.

BRIEF DESCRIPTION OF THE DRAWINGS

The teachings of the present invention can be readily understood by considering the following detailed description in conjunction with the accompanying drawings, in which:

FIG. 1 depicts a high level block diagram of an interactive information distribution system containing the present invention;

FIG. 2 depicts a flow diagram of a content provisioning method suitable for use in the information distribution system of FIG. 1; and

FIG. 3 depicts a flow diagram of a method for processing a content stream including meta-data suitable for use in the information distribution system of FIG. 1.

To facilitate understanding, identical reference numerals have been used, where possible, to designate identical elements that are common to the figures.

DETAILED DESCRIPTION

The present invention will be primarily described within the context of a video-on-demand (VOD) systems providing content encoded according to the various Moving Pictures Experts Group (MPEG) standards are known. For example, a first standard known as MPEG-1 refers to ISO/IEC standards 11172, which is incorporated herein by reference in its entirety. A second standard known as MPEG-2 refers to ISO/IEC standards 13818, which is incorporated herein by reference in its entirety. Additionally, a compressed digital video system is described in the Advanced Television Systems Committee (ATSC) digital television standard document A/53, incorporated herein by reference. It will be appreciated by those skilled in the art that the teachings of the present invention may be advantageously applied to other information distribution systems where components or functional elements within the system are bandwidth constrained.

Information content, illustratively a movie or other asset, is packaged by a system according to the invention as a very large object including all the video information (e.g., main, fast forward and fast rewind tracks, promotional tracks such as a movie information screen or movie trailer and the like), audio information, control information auxiliary information and the like.

The main track or "normal play" track of a video asset (e.g., a movie) comprises the main video portion of the asset. The fast forward (FF) track comprises, effectively, a temporally sub-sampled version of the main track. The fast rewind (REW) track comprises, effectively, a reverse-ordered and temporally sub-sampled version of the main track. Such FF and REW

tracks are suitable for enabling FF and REW functionality. That is, a subscriber may request that a presently presented program be "fast forwarded" or "rewound" to some future or previous point in the program at a rate of, e.g., 5 to 11 times the normal play rate. The server providing a main track to such a subscriber is responsive to a FF or REW command or request from the subscriber to access and begin streaming to the subscriber, respectively, the FF or REW track.

Promotional tracks comprise advertising or other promotional information that may be streamed to the subscriber prior to streaming the main track, during an intermission or at any other appropriate time. For example, a movie information screen (MIS) or movie trailer. An MIS comprises a still image or moving image representative of a movie that is available for selection by a user. The MIS may be provided as part of an interactive navigation system offering content selections to the user. The audio information comprises the main audio track, any foreign language audio tracks, any enhanced or special audio tracks and the like. The control information comprises on-screen navigation graphics, content indexing information and other control information.

The object also includes meta-data associated with the movie or other asset. For example, the meta data may include content-related information such as the title, description, actors, genre, ratings and the like. The meta data may also include ownership and access related information such as copyright information, allowable viewing window or allowable viewing time, when the movie is allowed to be offered to subscribers, when the offered movie must be withdrawn or made unavailable to subscribers or any other appropriate conditions that must be met to allow a viewer to view a title.

Upon receiving the object, the meta-data is examined and utilized by the server to provision itself. For example, if the meta-data includes a date and/or time in which the movie must be made available to subscribers, the server only makes the movie available at that date and/or time. Similarly, if the meta-data includes a date and/or time in which the movie must be made unavailable to subscribers, the server makes the movie unavailable (i.e., withdraws the movie from a list of available content) at that date and/or time.

FIG. 1 depicts a high level block diagram of an interactive information distribution system. Specifically, FIG. 1 depicts an interactive information distribution 100 comprising central information server equipment 101-105 providing, via an inter-server network 106, content to each of a plurality of head ends 107_1-107_n, where n is an integer. Each head end 107 is associated with a respective neighborhood 108 of set top terminals 109_1-109_m, where m is an integer. It should be noted that the number of set top terminals 109 included within each neighborhood 108 may be varied and is primarily restricted by the number of set top terminals 109 that the head end 107 serving the respective neighborhood 108 is capable of servicing. Each head end 107 includes a local storage device, illustratively a video server 107-VS, that is used to store content for subsequent distribution to set top terminals 109 within the neighborhood 108.

The central information server equipment 101-105 is responsible for "provisioning" each of the head end servers 107 with content such as audio-visual information streams (e.g., movies, television programs and the like) such that respective neighborhood 108 set top terminals 109 interacting with the head end 107 are able to access the stored audio visual information streams from the video server 107-VS within the respective head end.

Each head end 107 receives content and attribute information from the central information server equipment 101-105 via the inter-server network 106. The received content is synchronized with attribute data that is embedded as meta-data within the information stream(s) providing the content. The head end 107 retrieves the attribute data as meta-data, determines if the content should be provided to the respective neighborhood 108 immediately (i.e., no local storage), stored in the local storage device 107-VS or ignored entirely. The head end 107 then processes the data as necessary.

Each head end 107 also comprises an asset manager 107-AM. The asset manager 107-AM is a storage and management device for managing the various assets associated with a piece of content. Specifically, the asset manager 107-AM tracks the various assets and sub-content portions associated with each piece of content such that the system may extract the

appropriate content portions or related assets from memory, regardless of where that memory resides. Specifically, the asset manager stores information associating each content title with one or more of a movie information screen (MIS), a preview clip (PRE), a normal or play track (PLAY), a fast forward track (FF), a rewind track (REW), and other asset and/or content data associated with the content title. In this manner, the asset manager 107-AM relates the storage location of the various content and asset streams used for providing the content titles within the VOD system 100 of FIG. 1.

The central server equipment comprises a program scheduling and attribute generation system 101, a controller 102, a content storage module 103, a meta-data inserter 104 and an up-link/network processor module 105.

The content storage module 103 is used to store content, such as movies, television programs and other information streams that are used to provision the head ends 107. The stored information streams or content streams comprising synchronized video, audio, and other data are typically created at a remote encoding and/or authoring site (not shown) and stored in the content storage module 103. The content storage module 103, in response to commands received from the controller 102, provides content streams to the meta-data inserter 104.

The program scheduling and attribute generation system 101 is coupled to the controller 102 and provides the attribute information associated with each content stream, including attributes defining the scheduling of content distribution to the head ends and other temporal parameters stored within the content storage module 103. In this manner, the controller is able to determine which content streams should be retrieved from the content storage module and when such retrieval should occur.

The controller 102 coordinates the operations of the scheduling and attribute generation system 101, content storage module 103 and a meta-data inserter 104. Specifically, the controller 102, in response to the attribute information provided by the program scheduling and attribute generation system 101, causes a content stream to be coupled from the content storage module 103 to the meta-data inserter 104 at an appropriate

time. Before or during the streaming of content from the content storage module 103 to the meta-data inserter 104, the controller provides to the meta-data inserter 104 the attribute data associated with the streaming content.

The meta-data inserter inserts, into the content stream received from the content storage module 103, the associated attributed data produced by the program scheduling and attribute generation system 101 and provided by the controller 102. The resulting combined or synchronized content stream is provided to the uplink/network processor 105 for transport pre-processing prior to being coupled to the head-ends 107 via the inter-server network 106. In the preferred embodiment of the invention, the meta-data inserter insert the attribute data into the beginning of the content stream (i.e., prepends the attribute data to the content stream). In this manner, a server receiving the content stream may quickly determine whether the content stream should be processed further or ignored.

The program scheduling and attribute generation system 101 comprises a program scheduler 110 that communicates with a title and rights manager 111, a link scheduler 112 a work order manager 113 and other decision sources 114.

The title and rights database 111 comprises information defining a set of rules or rights that have been negotiated between the content producers and the owners of the interactive information distribution system 100 of FIG. 1. The title and rights database 111 communicates those rules or rights to the program scheduler 110. Additionally, the title and rights database includes information regarding required components or tracks for content streams to be provided to the head ends 107. These required components and tracks may comprise promotional information, movie trailers and the like.

The title and rights database 111 includes at least one of the following items associated with each program: title, VOD system identification number, duration of program rights (i.e., allowable time slot for providing or presenting the program), description of program, actors within program, director of program, distributor of program, closed captioning information, foreign language information, MPAA (Motion

Picture Association of America) ratings and other advisory information. Additionally, physical locations and status of programs and related components (date of acquisition or delivery, location of components of the asset within the central server and the like), packaging information (e.g., genre, category and the like) contract terms (dates, minimal resolution level and the like) specific exhibition rights, content or asset type data (movie, television show, movie information screen or promotional screen and the like), sampling rate and other parameters may also be associated with each title. Each title may also be associated with respective unique parameters as discussed above.

The information provided by the title and rights data base 111 is provided to the controller 102 via the program scheduler 110 for insertion within the content stream by the meta data inserter 104. In this manner, those title and rights items necessary to fulfill contractual and other obligations by the VOD system are transferred to the head end 107 receiving the content stream such that the head end is able to appropriately fulfill all contractual obligations regarding the content stream.

The program scheduler 110 plans movies, packages and lists for servers. The program scheduler 110 operates using at least one of the following attributes: First, the delivery loading and activation latencies at each video server site or head end 107. Second, the content contractual validation windows, for example, the dates and/or times defining windows within which the content is contractually required to be scheduled or required to be excluded from scheduling. These dates and/or times may define windows within which the content is available to set top terminals within a neighborhood or unavailable to the set top terminals within the neighborhood. Third, the programming schedules within the contractual windows. Fourth, groups of services (i.e., service groups or plans) based on predefined attributes (e.g., adults entertainment, non-adult entertainment, subcategories thereof and the like).

The program scheduler 110 also maintains a knowledge base associated with the characteristics of each video server head end 107 within the system. Specifically, the program scheduler 110 stores information regarding previously provisioned content to each head end such that the

program scheduler 110 maintains a list of the currently stored content at each head end. The program scheduler 110 provides content distribution plans including attribute data to the controller 102.

The work order manager (WOM) is a functional element that causes the creation or processing necessary to prepare content for use in the video-on-demand environment. Specifically, the work order manager is used to generate work orders, for each piece of content processed, to create the various tracks and/or assets associated with the content. For example, the work order manager generates work orders for the creation of the movie information screen (MIS), the preview editing, the encoding of the title, the fast forward and rewind tracks, and the like. Thus, the work order manager 113 determines the further processing requirements necessary to adapt content to the video-on-demand system and initiates work orders to various system components responsible for providing the necessary content-related components. The work order manager 113 cooperates with the program scheduler 110 to coordinate the flow of content being generated for subsequent provisioning of head ends or for subsequent inclusion in the content storage module 103. The work order manager 113 receives work order requests from the program scheduler 110 and communicates work order status information to the program scheduler 110. The work order manager 113 also receives, from the title and rights data base 111 directly or via program scheduler 110, information defining the appropriate components (e.g., sub-streams) used to form a complete content stream.

Other decision sources 114 cooperating with the program scheduler 110 may be used to provide attribute data associated with content intended for subscriber consumption. For example, historical data taken from a data warehouse system and suitable for use in determining title schedules, lists of internet web pages and the like. These other data sources may provide historical or statistical data that may be processed to determine an appropriate program schedule.

FIG. 2 depicts a flow diagram of a content provisioning method suitable for use in the information distribution system of FIG. 1. Specifically, FIG. 2 depicts a method 200 for provisioning a head end 107 within the information distribution system 100 of FIG. 1. The method 200

of FIG. 2 may be implemented in hardware, software or a combination of hardware and software. For example, the method may be implemented as a software routine running within the controller 102.

At step 210, a determination is made that content should be provided to one or more local servers (i.e., video servers 107-VS within head ends 107). That determination is made with respect to, per box 205, a request received from a head end, a scheduled delivery of content to a head end, a content updated provided by a content owner or provider for new content provided by a content owner or provider. These and other triggering events are relayed to the controller 102 via the program scheduler 110 or determined by the program scheduler directly.

At step 215, the delivery of the content to the head end is scheduled and attribute data associated with the content is provided. The content scheduling and attribute data is provided to the controller 102 by the program scheduling and attribute generation system 101.

At step 220, the attribute data is inserted into the content stream as meta-data. That is, at step 220 the attribute data provided by the program scheduling and attribute generation system 101 is inserted into or prepended to the content stream provided by the content storage module 103. The insertion or prepending of attribute data as meta-data is performed by the meta-data inserter 104 under control of the controller 102. The prepended data is provided as a separate MPEG transport stream (i.e., a "raw data" transport stream), multiplexed into the existing stream using a unique packet identifier (PID) while provided in a private data or other field of an MPEG stream.

The attribute data has special value in being associated with the content at the time of receipt, such as when prepended to content stream. The attribute data may also be transmitted prior to the content stream thereby allowing the local VOD Server to, for example, prepare or promote an anticipated content arrival, "next week,...Titanic [the latest movie title] will be available at ..." during VOD Navigation. This attribute information will be overwritten and/or supplemented to attribute information previously received during content stream delivery. For example, changes may be made to the viewing window, the a la carte price, the list of key stars, the

list of content genres the movie belongs with, and the Movie Description Screens (i.e., still or moving promotional tracks), and the like. The delivery method may be any valid form of transport. Examples, are Multicast File Transfer Protocol (MFTPO), MPEG over AAL5/ATM, MPEG over IP, or HS-ASI over fiber commonly assigned, simultaneously filed such as discussed in more detail in U.S. Patent Application No. _____ (Attorney Docket No. 051), which is incorporated herein by reference in its entirety. The association between content and attribute data is kept unique by a Title Identification Code for both the content and the attribute or Metadata.

At step 225, the content stream including the inserted or prepended attribute data is provided to one or more head ends or video server 107-VS intended to receive the data. It should be noted that the data may be provided generally on the network and that the prepended attribute data may indicate at which of the head ends 107 should actually receive and, if appropriate, store the content stream for subsequent redistribution to requesting subscribers.

FIG. 3 depicts a flow diagram of a method for processing a content stream including meta-data suitable for use in the information distribution system of FIG. 1. Specifically, FIG. 3 depicts a method for processing a content stream suitable for use in a head end 107 receiving a content stream including such meta-data.

At step 305, a head end 107 or video server 107-VS begins receiving a content stream via the inter-server network 106.

At step 310, a determination is made if the received content stream is intended for the receiving head end 107 or video server 107-VS. If it is determined that the received content stream is not intended for this server, then the method 300 is exited at step 315. Thus, the meta-data which is used in making this determination serves to avoid the head end processing of a content stream that is not intended to be received or utilized by this particular receiving head end 107.

At step 320, the received content stream, which has been determined to be intended for this server (per step 310), is stored per the attribute data embedded within the received content stream as meta-data. That is, in the case of a content stream intended to be provided directly to set top terminals

as a "live" broadcast or "pay per view event", the received content stream is point cast (i.e., individual stream for a set top terminal) or broadcast to each set top terminal that is authorized to decode the content stream. The authorized set top terminals then tune and decode the provided content stream. In the case of a content stream that is intended to be made available for subsequent use by requesting set top terminals, the received information stream is stored in the video server 107-VS of the head end 107. As previously noted with respect to attribute data and, specifically, the title and rights database, a received content stream may be associated with various contractual and other obligations that define, illustratively, date and/or times that the content is to be made available to set top terminals, the size of a display window used for promotional purposes during the presentation of the content stream and similar restrictions. This information is utilized by the head end to appropriately provide the content stream to requesting set top terminals.

At step 325, the content stream is served to subscribers in accordance with the attribute data. That is, the meta-data associated with the content stream is provided to subscribers in accordance with the limitations imposed on such provision by the attribute data.

The above-described method 300 provides, via the meta-data associated with a content stream, three broad categories of information; namely content programming parameters (e.g., title or program, actors within program, description of program, program genre, program category, director of program, distributor of program, closed captioning information, foreign language information, program rating and the like), content addressing parameters (e.g., receiving server identification, physical program component addresses, logical program component addresses and the like) and content utilization parameters (e.g., availability time slot, non-availability time slot, minimal presentation resolution level and the like).

The information distribution system 100 of FIG. 1 optionally includes a direct link between information sources and content owners/providers 150 and one or both of the content storage module 103 and the meta-data inserter 104. Utilizing this option, the information distribution system 100 provides a substantially direct link between initial content providers and

the information servers that interact with subscribers. In this manner, leased access of bandwidth and/or subscriber bases may be provided to entities outside of the standard information distribution system 100. Moreover, these outside entities (represented by the information sources and content owners/providers 150) may provide content directly to targeted subscribers and/or subscriber groups via an allocation of bandwidth and storage space on the head ends 107. The use of meta-data insertion within provided content streams allows the outside entities to efficiently manage "their" bandwidth, storage and other resource allocations within the information distribution system 100.

It should be noted that the point of introduction of content into the information distribution system 100 is described above within the context of a server centrally located with respect to a plurality of head ends 107. It should be noted that any one of the head ends 107, with appropriate connectivity functionality, may serve as the initial point of content introduction. In a networked server architecture, the point of content introduction will be at a single server site and content will be migrated from this site to its final destination on other server sites.

The above-described invention advantageously enables the provisioning of information servers in a manner allowing the information servers to process provided information streams in a somewhat autonomous manner such that the server does not need to communicate extensively about content-provisioning issues with an information production or transmission source.

To accomplish provisioning in an efficient manner, the subject invention utilizes central information source processing is co-located with an information production or transmission source, such as a satellite up link within a network of video servers that are provisioned by corresponding satellite down links.

Although various embodiments which incorporate the teachings of the present invention have been shown and described in detail herein, those skilled in the art can readily devise many other varied embodiments that still incorporate these teachings.

What is claimed is:

1. In an information distribution system including at least one information server (107) interacting with a respective group of subscribers (108), apparatus for provisioning an information server, comprising:

a controller (102), for synchronizing a content stream and attribute data associated with the content stream, said attribute data indicative of at least an information server utilizing said content stream; and

a data inserter (104), for inserting said respective attribute data into said content stream.

2. The apparatus of claim 1, wherein said apparatus provisions said at least one information server via a communications network (106) and said attribute data includes identification data associated with said server utilizing said content stream.

3. The apparatus of claim 1, wherein said data inserter prepends said attribute data to said content stream.

4. The apparatus of claim 1, wherein said attribute data comprises at least one of the following content programming parameters: title or program, actors within program, description of program, program genre, program category, director of program, distributor of program, closed captioning information, foreign language information and program rating.

5. The apparatus of claim 1, wherein said attribute data comprises at least one of the following content addressing parameters: receiving server identification, physical program component addresses and logical program component addresses.

6. The apparatus of claim 1, wherein said attribute data comprises at least one of the following content utilization parameters: availability time slot, non-availability time slot and minimal presentation resolution level

7. The apparatus of claim 1, wherein said meta-data inserter includes meta-data within the content stream within a private data portion of the data stream.

8. A method for providing content to servers (107) within an information distribution system, said servers providing said content to corresponding groups of subscribers (108), said method comprising the steps of:

including, within each content stream to be provided to said servers, meta-data indicative of at least a server intended to receive said content stream; and

providing, via a communications network, said content stream including said attribute data to at least said server intended to receive said content stream.

9. The method of claim 8, wherein said communications network comprises an inter-server network communicating with a plurality of servers within said information distribution system, each of said plurality of servers examining said meta-data to determine whether said content stream including said meta data is to be stored in said server.

10. The method of claim 9, wherein said meta data comprises at least one of the following content addressing parameters: receiving server identification, physical program component addresses and logical program component addresses, said content addressing parameters being suitable for use in determining whether said content stream should be stored by a server.

11. A method for providing content to servers within an information distribution system, said servers (107) providing said content to corresponding groups of subscribers (108), said method comprising the steps of:

determining (210) that content should be provided to a server;

scheduling (215) the delivery of said content to said server;

inserting (220), within an information stream including said content, attribute data identifying said server intended to receive said content; and

providing (225) said information stream including said content and said attribute data to each of a plurality of servers including said at least one server intended to receive said content.

12. The method of claim 11, wherein said determination to provide content to a server is made in response to one or more of a request for said content from said server, a scheduled delivery of said content to said server, an update of content already provided to said server and the receipt of new content to be provided to said server.

13. The method of claim 12, wherein said attribute data comprises at least one of the following programming parameters associated with said content: title of program, actors within program, description of program, program genre, program category, director of program, distributor of program, closed captioning information, four language information and program rating.

14. The method of claim 12, wherein said attribute data comprises at least one of the following addressing parameters associated with said content: receiving server identification, physical program component addresses and logical program component addresses.

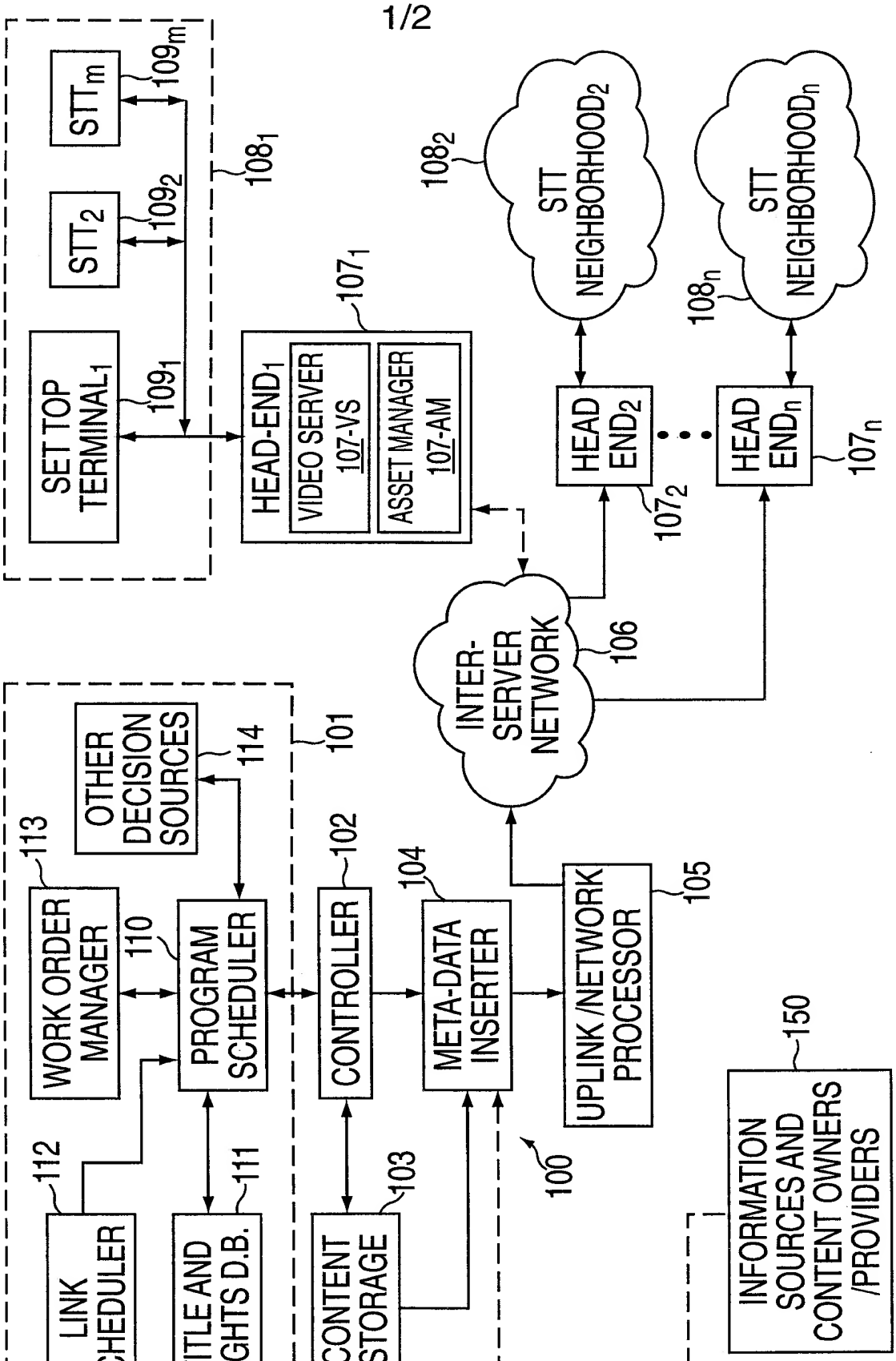
SET TOP TERMINAL1
STT2
STTm
1091
1092
109m
1081
HEAD-END1
VIDEO SERVER 107-VS
ASSET MANAGER 107-AM
1071
1082
STT NEIGHBORHOOD2
108n
STT NEIGHBORHOODn
HEAD END2
HEAD ENDn
1072
107n
INTER-SERVER NETWORK
106
OTHER DECISION SOURCES
114
101
113
WORK ORDER MANAGER
110
PROGRAM SCHEDULER
102
CONTROLLER
104
META-DATA INSERTER
UPLINK /NETWORK PROCESSOR
105
112
LINK SCHEDULER
111
TITLE AND RIGHTS D.B.
103
CONTENT STORAGE
100
150
INFORMATION SOURCES AND CONTENT OWNERS /PROVIDERS

FIG. 1

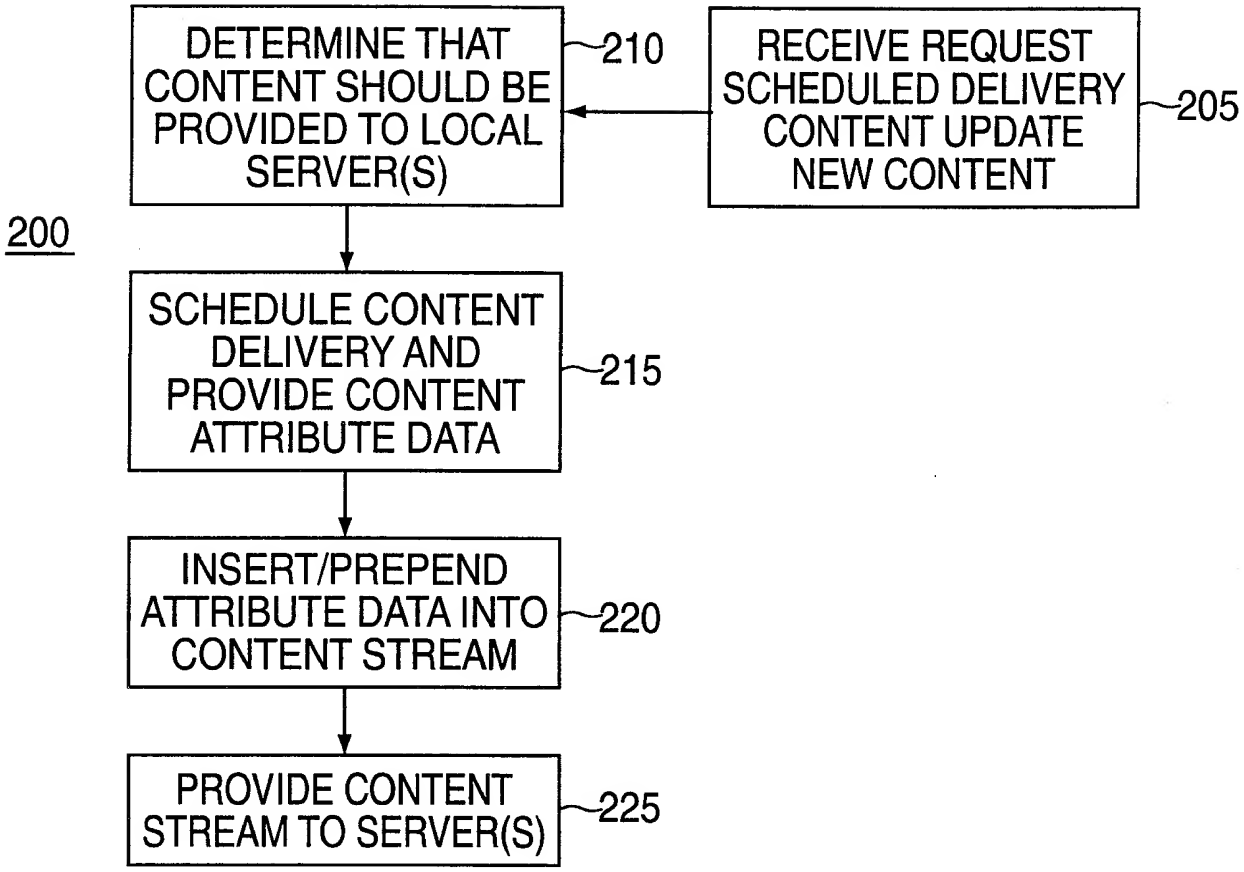
DETERMINE THAT CONTENT SHOULD BE PROVIDED TO LOCAL SERVER(S)
210
RECEIVE REQUEST SCHEDULED DELIVERY CONTENT UPDATE NEW CONTENT
205
200
SCHEDULE CONTENT DELIVERY AND PROVIDE CONTENT ATTRIBUTE DATA
215
INSERT/PREPEND ATTRIBUTE DATA INTO CONTENT STREAM
220
PROVIDE CONTENT STREAM TO SERVER(S)
225

FIG. 2

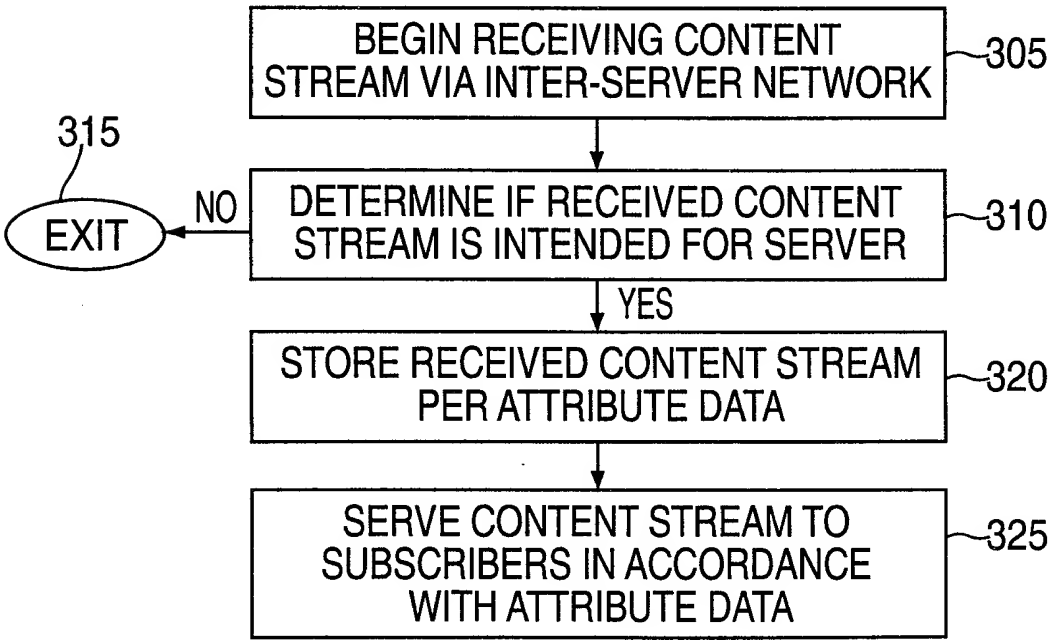
BEGIN RECEIVING CONTENT STREAM VIA INTER-SERVER NETWORK
305
315
EXIT
NO
DETERMINE IF RECEIVED CONTENT STREAM IS INTENDED FOR SERVER
310
YES
STORE RECEIVED CONTENT STREAM PER ATTRIBUTE DATA
320
SERVE CONTENT STREAM TO SUBSCRIBERS IN ACCORDANCE WITH ATTRIBUTE DATA
325

FIG. 3